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MODELLING THE EFFECT OF EU POLICY REFORMS ON FARM INVESTMENT BEHAVIOUR

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Abstract

The objective of this paper is to analyse farm strategies and investment behaviour in a sample of selected Italian farm-households facing different scenarios, with a particular focus on the effects of the 2003 CAP reform. Models were built for individual households using multi-criteria dynamic programming, including investment choice. A total of 24 farms were selected for modelling, all located in Emilia Romagna (Italy). The simulations show a strong effect of both policy and markets scenarios on household investment, though the latter seems more relevant than the former. However, decoupling itself shows minor effects in the majority of cases. The models offer useful insights about the mechanisms of adaptation and their implications for the effects of policies. The main drawbacks are in the heavy data collection and computational requirements, and in the related difficulties to achieve a satisfactory degree of representativeness.

Key words: CAP reform, decoupling, investment, multicriteria, dynamic, models

1. Background and objectives

Decoupling of direct payments from production, started in 2003, set a major step in the reform of the Common Agricultural Policy (CAP). In the past years a number of studies have addressed the issue of the impact of EU policy reforms. These studies concern different territorial levels and in many cases focus on the effects of reforms on the market of agricultural products. On the contrary, long term effects of policy changes and related impacts on structural and investment behaviour received relatively little attention in modelling exercises concerning CAP reform up to now.

The objective of this paper is to analyse farm strategies and investment behaviour in a sample of selected Italian farm-households facing different scenarios (with a particular focus on the effects of CAP).

The simulations are performed using individual household multi-criteria dynamic programming models, including investment choice. Simulations are performed for sample of 24 farms located in Emilia Romagna (Italy).

The remainder of the paper is organised as follows. Section 2 illustrates the methodology adopted in this paper. Section 3 illustrates the empirical application to case studies in Italy. Section 4 reports the results, while section 5 provides a discussion.

2. Metodology

The approach used in this paper is to model individual households using multi-criteria dynamic programming, including investment choice. The models are then used simulate the effects of scenarios on investment behaviour.

The reference investment framework for our approach is provided by Gardebroeck and Oude Lansik (2004) who develop a comprehensive theoretical model of farm investment, building on the main literature concerning investments. One way of implementing such model in a computationally tractable way is to adopt dynamic mathematical programming (see e.g., Asseldonk et al., 1999). The main drawbacks of such models are in the simplification of the behavioural assumptions, which are based on profit maximisation, and in the fact that it assumes the farm as an independent entity. In order to deal with at least the first of these problems, Wallace and Moss (2002) propose a multi-criteria approach and apply it to strategic decisions from the viewpoint of the farm household.

The model used in this paper is the result of the integration of the previous works. It can be generally represented as follows:

$$Z(x) = F\left[z_1(x), z_2(x), \ldots z_q(x) \ldots, z_Q(x)\right] \quad (1)$$

s.t.

$$x \in X \quad (2)$$

$$x \geq 0 \quad (3)$$

where:

Z = objective function;

z_q = value of attribute/objective q;

X = feasible set;

x = vector of decision variables;

The detailed specification is not reported here, but is available in Gallerani et al. (forthcoming). The decision variables include allocation of labour (on- and off-farm), allocation of capital (on- and off farm), investment and disinvestment decisions, crop mix. The model runs on a 25-years period (2006-2030). The objective variables are an aggregation of performances over time. They include Household worth, Household consumption, Household debt/asset ratio, Diversification in household activities, Income certainty, Leisure time.

The simulation has been run under six scenarios (Table 1).

Table 1 – Main characteristics of the scenarios

Scenario	Payment 2006-2013	Payment 2014-2021	Effect financial discipline	Prices 2006-2013
1	Area based	= 2006-2013	-10%	=
2.1	Decoupled	= 2006-2013	-10%	=
2.2	Decoupled	= 2006-2013	-10%	-20%
3.1	Decoupled	0	-10%	=
3.2	Decoupled	Linear reduction to 0	-10%	=
3.3	Decoupled	Linear reduction to 0	-10%	-20%

Scenario 1 is used as the baseline against which changes are assessed. Scenarios 2 provide a decoupling situation with continuation of payments beyond 2013 and with present prices of

agricultural products (Scenario 2.1) or with a reduction of prices by 20% (Scenario 2.2.). Scenario 3 assumes changes in payments beyond 2013, with total abolishment (Scenario 3.1) or a progressive reduction. The case of progressive reduction is represented with present prices (Scenario 3.2) or with a reduction of prices by 20% (Scenario 3.3).

3. Case studies and empirical application

The case study concerns the modelling of a sample of real farms located in Emilia Romagna (Northern Italy). Farmers' sample was selected in order to fit in the intersection of the following categories: different altitudes (plain/mountain); different specialisation (arable crops, livestock, trees), different technology (conventional, organic). The survey included information about farm and household structure, expectations, reaction to planned and intended investment, as well as about potential reforms such as decoupling of EU payments. A total of 24 farms were selected for modelling. Their characteristics are summarised in Table 2.

Table 2 – Main characteristics of the farms modelled

	Household CODE	Legal Status (1)	N. household members	Age farmer	Use external labour	Members working off farm	Houshold debt/asset ratio	Land owned (ha)	Land rented in (ha)	Land rented out (ha)	Technology	SFP (euro)	SFP/income ratio	Number of rights (ha)
Mountain Arable	ITMCA09	LC	4	76	no	yes	35%	34	0	0	C	1050	6%	5
	ITMCA16	LC	6	60	yes	yes	0%	17	60	0	C	7000		20
	ITMCA21	LC	4	76	no	yes	10%	41	0	0	C	5000	7%	22
	ITMEA54	FR	4	39	no	yes	0%	25	25	0	O	4000		20
	ITMEA57	FR	4	60	no	yes	0%	70	35	0	O	9000		9
	ITMEA63	LC	2	56	no	no	0%	11	33	0	O	900	6%	2
Mountain Livestock	ITMCL76	LC	6	42	no	no	30%	11.93	85	0	C	15500		39
	ITMCL77	FR	4	64	no	no	2%	11.34	34.03	0	C	11000	19%	27
	ITMCL79	FR	6	34	no	yes	0%	7.65	7.15	0	C	6722	16%	17
	ITMEL46	LC	5	59	no	no	0%	22	26	0	O	2000		4
	ITMEL61	LC	4	64	no	no	0%	150	7	0	O	14000	47%	157
Plain Arable	ITPCA15	FR	3	44	yes	yes	10%	17	106	0	C	17000	57%	33
	ITPCA19	FR	5	45	yes	yes	3%	65	45	0	C	28500	29%	101
	ITPCA23	FR	3	47	no	no	17%	0	24	0	C	11500	36%	40
	ITPCA27	FR	2	61	yes	yes	1%	324	0	0	C	58000		176
	ITPEA51	FR	2	50	no	no	0%	7	2.9	0	O	1500	3%	9
	ITPEA66	FR	3	48	no	yes	0%	5		0	O	500	2%	5
Plain Livestock	ITPCL08	FR	3	63	yes	yes	0%	17.4	7	0	C	12000	15%	11
	ITPCL78	LC	3	55	no	yes	2%	45.37	11.34	0	C	32500	68%	81
	ITPCL80	LC	4	55	no	no	8%	5.7	46	0	C	0	0%	0
	ITPEL59	FR	4	39	yes	no	0%	140	110	0	O	10000		25

(1) LC = Limited company; FR = Family run
(2) C = Conventional; O = Organic

The structure of the sample was chosen in order to represent the complexity of farming systems in the area, characterised by a strong heterogeneity of specialisation, structure and connection with non-farming activities. Tree crops are not considered here as they are only moderately affected by EU payments.

Models were calibrated using mostly primary household/farm information collected during the survey. The use of secondary data was restricted to the market values of farm assets, mostly not known to the farm, and the calculation of revenues from single crops. For the latter purpose, regional FADN information was used. The data collection was conducted in 2006 and information was referred to the most recent year available.

4. Results

The results are illustrated grouping farms according to the four main farming systems identified: Mountain Arable, Mountain Livestock, Plain Arable, Plain Livestock. Results are expressed for scenarios 2.1 to 3.3. as percent change with respect to Scenario 1.

In the case of mountain arable farms, investment tended to show little reaction to decoupling (scenario 2.1), but reacted sharply to price changes (scenario 2.2) and, to a lesser extent, to payment cuts (scenarios 3.1, 3.2 and 3.3). The reaction tended to be more often characterised by an increase in investment in the first period and by a decrease (in some cases a total halt) in investment in the second period (Table 3).

Table 3 – Impact of the scenarios on investment - Italy – Mountain - Arable

		2.1	2.2	3.1	3.2	3.3
2006-2013	ITMCA9	0%	0%	0%	0%	0%
	ITMCA16	0%	17%	10%	2%	17%
	ITMCA21	0%	0%	0%	0%	0%
	ITMEA54	0%	751%	0%	0%	2269%
	ITMEA57	0%	26%	10%	10%	26%
	ITMEA63	0%	0%	0%	0%	0%
2006-2013	ITMCA9	0%	0%	0%	0%	0%
	ITMCA16	0%	-118%	-44%	-89%	-53%
	ITMCA21	0%	-101%	0%	0%	0%
	ITMEA54	0%	-100%	0%	0%	-100%
	ITMEA57	-1%	-100%	-100%	-100%	-99%
	ITMEA63	0%	0%	0%	0%	0%

Livestock farms tended to have a sharper reaction to decoupling and to have a generally more homogeneous patter of reaction to the other scenarios, though impacts on investment still tended to reflect a variety of strategies (Table 4).

Table 4 – Impact of the scenarios on investment1 - Italy – Mountain - Livestock

		2.1	2.2	3.1	3.2	3.3
2006-2013	IT M C L 67	-41%	-307%	-41%	-41%	-331%
	IT M C L 76	-25%	17%	-5%	-25%	-24%
	IT M C L 79	0%	0%	0%	0%	0%
	IT M E L 46	0%	-295%	-181%	-181%	-314%
	IT M E L 61	0%	0%	0%	0%	0%
2014-2021	IT M C L 67	-39%	-100%	-39%	-39%	-100%
	IT M C L 76	-4%	0%	-1%	-2%	-3%
	IT M C L 79	0%	0%	0%	0%	0%
	IT M E L 46	0%	-100%	-100%	-100%	-100%
	IT M E L 61	0%	1%	0%	0%	0%

In this case, however, the effect of investment is negative whatever the scenario.

As a reaction to decoupling, investment in plain, arable crop farms tended to either decrease or stay stable, with one exception (Table 5).

Table 5 – Impact of the scenarios on investment - Italy – Plain - Arable

		2.1	2.2	3.1	3.2	3.3
2006-2013	ITPCA15	0%	2%	0%	0%	1154%
	ITPCA19	-127%	-127%	-127%	-127%	-127%
	ITPCA23	0%	-2%	-4%	-120%	0%
	ITPCA27	-3533%	-4423%	-15191%	-3675%	-15237%
	ITPEA51	0%	0%	0%	0%	0%
	ITPEA66	0%	0%	0%	0%	0%
2006-2013	ITPCA15	0%	-15%	0%	0%	-114%
	ITPCA19	-40%	-40%	-40%	-40%	-40%
	ITPCA23	96%	38%	93%	66%	42%
	ITPCA27	-112%	28%	-114%	-119%	-100%
	ITPEA51	0%	0%	0%	0%	0%
	ITPEA66	-	-	-	-	-

Farms reacted either immediately or in the second period. Price decreases tended to cause a drop in investments in the second period, though at least one farm reacted with a temporary increase in investment in the first period (scenario 2.2). Payment cuts also caused a reduction in investment, though this was far less relevant than price reduction (scenarios 3.1, 3.2 and 3.3).

In plain livestock farms, investments tended to stay steady with decoupling, while an increase seemed to prevail with price reductions, at least in the first period (Table 6).

[1] Investments were already negative in the baseline scenario in the farm ITML76

Table 6 – Impact of the scenarios on investment - Italy – Plain - Livestock

		2.1	2.2	3.1	3.2	3.3
2006-2013	IT P C L 08	0%	5%	0%	0%	2%
	IT P C L 78	0%	113%	22%	0%	137%
	IT P C L 80	0%	3%	0%	0%	-141%
	IT P E L 59	3%	-49%	7%	10%	-54%
2014-2021	IT P C L 08	0%	-23%	0%	1%	-41%
	IT P C L 78	0%	8%	2%	1%	-14%
	IT P C L 80	0%	0%	0%	0%	-100%
	IT P E L 59	-1%	-22%	-4%	-3%	-32%

A reduction in payments causes partly the same reaction in the first period, and, in some farms, also in the second. Such investments have mostly to be interpreted as the need to adapt capital stock as a consequence of changing incentives.

5. Discussion

The simulations show a strong effect of both policy and markets scenarios on investment, though the latter seems more relevant than the former. Decoupling itself shows negligible or no effect in the majority of cases, while only 4 farms out of 24 (16%) show important reactions in terms of investment, mostly with a reduction. Effects are rather diversified among the various farm specialisations and the single farms.

The model offer useful insights about the mechanisms of adaptation and their implications for the effects of policies. Taking into account of the whole household decision problems, it allows considering trade offs between on-farm and off-farm use of resources (labour, capital). It also allows including land buying/selling and investment path given the initial resource endowment. The use of a dynamic perspective allows identifying adaptation paths, anticipation and long term effects of policy decisions. The main drawbacks are in the heavy data collection and computational requirements, and in the difficulties to achieve a satisfactory degree of representativeness.

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